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Revisiting the Relationship between Ability and Sheepskin Effects of Schooling on Individual Earnings: The Case of Pakistan

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Abstract

Significant amount of recent research continues to produce evidence in support of the presence of sheepskin effects in returns to schooling both for developed and developing countries. However, researchers have not made many attempts to identify or empirically test the possible mechanisms that may generate such effects. A few noteworthy exceptions are Flores-Lagunes and Light (2010) for the U. S., Riddle (2008) for Canada and Shabbir & Ashraf (2011) and Shabbir (2013) for Pakistan.

Shabbir and Ashraf (2011) summarily reports that the sheepskin effects for rural Pakistan persist in the face of controls for measures of innate and cognitive ability. The present paper revisits this issue and adds value by presenting and discussing all of the relevant empirical estimates in full detail. Further, the present analysis fully updates the review of the literature as well as the various aspects of the pertinent debate surrounding the nature of the sheepskin effects.

This study reconfirms that significant sheepskin effects exist for rural Pakistan for diplomas obtained by completing primary, high school and perhaps also FA and BA levels. Further, according to the detailed empirical regression results presented and discussed in this paper, the sheepskin effects prove to be robust both to an inclusion of measure of innate ability (Raven Progressive Matrices) and 'cognitive' ability (specially administrated tests of literacy and numeracy). This implies that sheepskin effects 'signal' individual characteristics unrelated to these measures of ability. The findings have significant policy implications about the nature of the private vs. social returns to schooling.

Keywords: human capital investments, returns to education, ability, sheepskin effects, earnings, schooling, developing countries, Pakistan.

1. Introduction

1.1 Motivation and Theoretical Background

Researchers have conducted a large number of empirical studies based on the premise of the observed earning-schooling correlation. A majority of such studies are in the human capital tradition founded by Becker (1964) and then popularized by the follow-on work of Mincer (1974). The well-known human capital model considers schooling as an investment that produces marketable skills and there is a positive net pay off to this investment resulting in a positive rate of return to years of schooling. Per this 'traditional' approach, the observed correlation between years of completed schooling and individual earnings (controlling for labor market experience) signifies the pecuniary value placed on the productivity-enhancing skills produced because of investment in schooling. However, this stance is challenged by the 'screening' or 'signaling' hypothesis due to Arrow (1974) and Spence (1974) wherein schooling, especially in its diploma granting role, may only be reflecting pre-existing abilities or personal characteristics such as resilience and perseverance which may be hard to observe directly. Qualities such as perseverance or innate abilities are generally hard to observe directly but are valuable in the profit-maximizing 'world of work'. In this alternative model, the employers pay for the 'signal' that schooling entails and this is the phenomenon that generates the observed positive earnings-schooling correlation. A variant of signaling viewpoint is the 'sheepskin' hypothesis where the diploma granting years of schooling confer a 'bonus' or discontinuously higher rate of return. Such completion of degrees/diplomas may be a proxy for individual ability or other personal attributes such as perseverance and motivation to complete a task. Besides wielding obvious analytical importance, this distinction between these two contending schools of thought carry great practical significance as well, since sheepskin effects imply that the social rates of return to schooling will be lower as compared with the private counterparts. In principle, such knowledge should be a very valuable guide for the allocation of scarce public funds towards schooling - an issue particularly important for developing countries with relatively tight budget constraints.

1.2 Empirical Perspective

Since the landmark empirical study of Hungerford & Solon (1987) for the U. S., there has been a growing stockpile of studies that have reported significant sheepskin effects for both the developed as well as the developing countries. I have reviewed some of these studies in the next section. However, despite this growing stock of empirical evidence of sheepskin effects, there is relatively little exploration of the natural follow-on question: what is the nature of these sheepskin effects? What is the mechanism that generates these nonlinearities in the earnings-schooling nexus? Knowing an answer to this question should inform us, in part, about the relative strength of the contending explanations that comprise the human capital hypothesis versus signaling or sheepskin explanation. Further, this deeper exploration of the relatively widely reported sheepskin effects would inform the policy options as well.

Taking advantage of a relatively unique data set for a developing country, Pakistan, the present study reports detailed empirical results regarding (a) existence of sheepskin effects for rural Pakistan and (b) explores if such affects represent measured ability - both innate and cognitive. As discussed in the next section, this turns out to be amongst a few research exercises of its nature either for the developed or developing countries.

1.3 Organizational Structure of the Paper

Section 2 and 3 contain a detailed review of the relevant literature – former presents general review whereas section 3 presents the corresponding literature specifically for Pakistan. Section 4 presents the specification of the model and the proposed methodology while section 5 contains a description of the data set used. Section 6 presents and discusses the empirical results of the study followed by the concluding section 7.

2. Literature Review

2.1 Existence of Sheepskin Effects

Continuing a trend that started in the last two or three decades, considerable recent research continues to produce empirical evidence that sheepskin effects exist for both the developed and the developing countries.

Let us start with the relevant evidence for the United States. Hungerfold & Solon (1987) led a spate of empirical studies that reported the existence sheepskin effects in returns to schooling for the U. S. It reported positive and significant sheepskin effects for several degree levels of schooling completion for a sample of white males. Belman & Heywood (1991), another influential empirical study, followed Hungerford & Solon (1987). It confirmed the sheepskin effects of education for minorities and women in the United States. Later studies for the U.S. such as Park (1999), and Flores-Lagunes & Light (2010) helped to further build this trend by confirming the existence of sheepskin effects. This interest in testing for the sheepskin effects for the U. S. has been maintained in several more recent studies such as Heckman et al. (2008), which is based on the CPS data, and, Gittel et al. (2017) which finds bonus or extra return for completion of an Associate's degree vs. 'Some college'.

Regarding other developed countries, representative studies reporting sheepskin effects of schooling include Hui (2004) and Ferrer & Riddle (2008) for Canada, McGuinness (2003) for Ireland, Antelius (2000) for Europe, Bauer et al. (2005) and Sugaa (2017) for Japan. Besides these country specific studies, Denny and Harmon (2001) report sheepskin effects for five countries – four European and U. S. Two other multi-country studies are also noteworthy – Trostel (2005) that includes US, Russia, New Zealand, Australia and 8 European countries and Rodriguez et al. (2015) which is a meta study of high school diploma sheepskin effects based on 122 studies for countries including many developed countries.

With reference to the developing countries other than Pakistan, there are several examples of sheepskin studies. They include Schady (2003) and Olfindo (2018) for the Philippines et al. (2016) for Indonesia et al. (2009) for Brazil et al. (2014) for Argentina et al. (2017) for Tunisia et al. (2013) for China et al. (2004) for Hong Kong et al. (2008) for Colombia and Salehi-Isfahani (2009) for Egypt, Iran and Turkey.

2.2 Possible Interpretations

In light of the myriad studies reporting the existence of sheepskin effects, it would be natural to query about the nature of such effects. What are the mechanisms giving rise to such effects? Broadly speaking, sheepskin effects may be reflective of such factors as the family background, 'ability', impact of institutional diversity, personal characteristics that may be valued in the world of work but may be hard to observe or measure, and even 'lumpiness' in the acquisition of skills/human capital due to the existence of a possible 'threshold' level.

Intuitively, 'ability' may be a latent factor manifesting itself as completion of a degree or diploma vs dropping out. Thus, sheepskin effect may be a proxy for ability to persevere with a goal, self-determination, and even innate cognitive ability that facilitates completion of a program. Such characteristics of prospective employees will be naturally valuable to an employer and, in the absence of readily available or direct measures of such qualities; employers monetarily reward such 'signals'. This explanation, if true, will dampen the human capital hypothesis that schooling surely and simply produces marketable skills that garner pecuniary rewards in terms of higher wages. However, in theory at least, it is possible that human capital is acquired in a non-linear fashion and these diploma or sheepskin effects merely mark the 'threshold levels' whereby the learning reaches a critical mass resulting in certain 'lumpiness' in acquisition of skills/human capital. Of course, such an explanation will still preserve the human capital explanation for the role of schooling in the context of the earnings-schooling observed positive correlation.

While there are other possible explanations that may consistently explain the nature of the observed sheepskin effects, in general, not many such studies exist for the developing or the developed countries. Following are, however, a few noteworthy exceptions in terms of such studies that specify, test and discuss possible mechanisms that may underlie the 'sheepskin' signals.

For the U. S., Arkes (1999) hypothesizes and presents supportive empirical evidence that employers are able to infer 'pre-college' abilities from certain degree completions while they may be using other sheepskin signals for 'unobserved' characteristics such as motivation and perseverance. In a similar vein & Zayats (2006), utilizing a data set for the Philippines while focusing on controlling for 'ability bias', contends that dropouts may have lower ability so, by implication, completion should proxy relatively higher ability. While this study speculates that sheepskin effects reported for the Philippines by Schady (2003) could be 'explained' by Zayats's Raven-like ability measure, no such analysis is actually undertaken. On the other hand, Shabbir & Ashraf (2011) summarily reports that the sheepskin effects for rural Pakistan persist in the face of controls for measures of innate and cognitive ability. Riddle (2008) reaches a similar conclusion regarding robustness of sheepskin effects for Canada using a measure of cognitive skills – "specifically literacy, numeracy and problem-solving skills". In Canada's case, also see another relevant study that analyzes the interaction of ability and sheepskin effects, Flores-Lagunes and Light (2010). Finally, Habermalz (2003) actually contends that ability bias leads to a significant under-reporting of the sheepskin effects over time in a sample for the U. S.

In terms of testing whether sheepskin may be a proxy for family background, Shabbir (2013), presents evidence that the sheepskin effects in a nationally representative data sample for Pakistan are robust to inclusion of measured family background. However, this clearly leaves the question of unobserved family background, amongst other factors, open.

Regarding the role of 'lumpiness' or 'threshold' effect in human capital acquisition in the sheepskin debate, Patrinos (1996) using evidence for Guatemala conjectures that human capital skills are acquired in a non-linear fashion and observed sheepskin effects may only represent ‘threshold levels of human capital’. However, his analysis does not go beyond making this conjecture since the author does not undertake any empirical analysis to test such a hypothesis directly.

Van de Werfhorst (2011) presents a somewhat more novel explanation of the sheepskin effects by considering them to be due to the diversity of educational systems across countries. As a last example of other possible emerging explanations for sheepskin effects, note that Mehta & Villarreal (2008) consider the segmentation of Mexico’s labor market as the ‘causative factor’ leading to the absence and presence of sheepskin effects in that country.

The above is not a comprehensive list of an emerging trend in trying to explain the mechanism that may underlie the observed ‘sheepskin’ effects. However, such studies are still relatively few and very much needed.

3. Sheepskin Effects in the Case of Pakistan

3.1 Testing the Sheepskin Hypothesis for Pakistan: Overcoming a Data Challenge

Despite significance of the sheepskin hypothesis and a growing empirical literature about its testing worldwide, historically, there have been only a few studies for Pakistan. One possible reason for the dearth of such studies may be the fact that data on an individual’s schooling is generally not available in the metric of ‘years of completed schooling’, which is required to be able to test this hypothesis properly. Instead of being available as information about the above continuous variable, typical micro level data sets such as Household Income and Expenditure Surveys, categorize it as a discrete variable making it unsuitable for testing the sheepskin hypothesis a la the seminal work of Hungerford & Solon (1987), for example. For more details about this data deficiency, and one of the earliest attempts to overcome it, see Shabbir (1991).

The root of the data deficiency problem is that HIES type surveys do not ask a question such as “What is your completed years of schooling?” Instead, in essence, individuals are asked if they started “Primary but did not finish High School”, started High School but did not finish College” etc. Clearly, such sample questionnaire structure results in imprecise information about the exact number of years of schooling completed by a person, making such a sample inappropriate for a test of the ‘sheepskin’ hypothesis.

This being a very common data deficiency in the case of Pakistan renders the relatively few samples such as the one used in this paper a comparatively rare opportunity to test the sheepskin hypothesis.

Incidentally, the few studies for Pakistan such as Nasir (2002), Awan & Hussain (2007), Khan (2008) and apparently even Aslam et al. (2012) do not have raw schooling data available as continuous years of schooling even though one of their stated objectives is to ascertain ‘credential’ or ‘sheepskin’ effects of schooling. Interestingly, while Malik and Awan (2016) that uses relatively recent HIES sample to estimate rates of return to schooling for Pakistan, appears to note that the study utilizes actual years of completed schooling (which would constitute a departure from the historical way such surveys measure this variable), they do not conduct a test of the sheepskin hypothesis. However, theirs is still an interesting study for related reasons since it controls for 'ability' in the form of a 'within household' latent factor. Subject to an interpretation of exactly what unobserved household characteristics are being 'controlled for', this may provide relatively more unbiased estimates of rates of returns for schooling.

3.1 Interpreting the Sheepskin Effects for Pakistan: Role of Innate and Cognitive Ability

Given the evidence of sheepskin effects in returns to schooling in Pakistan, it is important to explore the mechanisms that may underlie these elevated non-linearity in returns that correspond to this years of schooling that mark completion of a degree or diploma.

In principle, such sheepskin effects may represent myriad different factors such as 'ability' – both cognitive and innate, family background and other unobserved personal attributes such as perseverance, goal-orientation and the motivation to complete a program once started. There are few attempts to explore empirically the nature of the sheepskin 'signal'.

Besides Shabbir (2013), which tests for the possibility that measured family background (such as parental education) may mediate observed sheepskin effects in a national sample for Pakistan, other studies such as Shabbir (2011), Aslam et al. (2012) and Alderman et al. (1996) are amongst the few attempts to explore the role of 'ability' in this context.

The present study, based on the International Food Policy Research Institute (IFPRI) 1987 sample of rural Pakistan, adds to this sparse but important literature by reporting detailed estimates of the existence of the sheepskin effects and the subsequently testing the extent to which such effects are robust in the face of measures of cognitive and/or innate ability. This study contributes towards the untangling of the question of the relative contribution of human capital type of productivity-enhancing effects as against the sheepskin effects. It also addresses the question whether the observed sheepskin effects represent 'ability' or are independent of such factors.

4. Methodology and Model Specification

4.1 Baseline Specification: Human Capital (HC)

To motivate the testing of sheepskin effects and subsequently controlling for measures of ability is to start with the 'baseline' Mincerian human capital (HC) specification. The equation (1) presents a simplified version of the familiar log-linear specification where Ln Y is the natural log of individual earnings, S, years of completed schooling while we leave out of the specification the years of labor market experience (and the error term) for simplicity.

$$\text{Ln } Y = \alpha + \beta 1 \, S \qquad (1)$$

Note that per (1), $\beta 1$ i. e. the marginal rate of return to schooling is a constant.

4.2 Testing for Sheepskin Effects

Sheepskin hypothesis essentially implies that years of schooling that mark the completion of a degree or diploma are 'special' as they exhibit a 'bonus' added to the constant rate of return, $\beta 1$above. By varying (1), we can introduce these nonlinear effects by:

(a) Allowing for discontinuities at values of S that correspond with an award of degree/diploma. Let us refer to this as Sheepskin Dummies Model or DM or Model I.

(b) Taking a non-parametric approach to specify Ln Y to be a discrete step function of S with each year schooling is represented as a (0,1) variable. Let us refer to this as Sheepskin Step-function Model or SM or Model II.

Let us incorporate (a) and (b), in turn, into specification (1) that represents the baseline HC model. (For details, see Shabbir (2013).

Model I: Sheepskin Dummies Model or DM

Assume that there are only two 'diploma years' one at ten and the other at twelve years of completed schooling. Let us represent each of these by two dichotomous (0, 1) variables, D10 and D12, where $D10 = 1$ if $S \geq 10$ and $D12 = 1$ if $S \geq 12$.

The relevant discontinuities representing possible sheepskin effects for 10 and 12 years of completed years of schooling are allowed for by simply introducing D10 and D12 to the baseline 'Mincerian' human capital function as follows.

$$\text{Ln } Y = \alpha + \beta 1 S + \beta 2 D10 + \beta 3 D12 + \mu 2 \qquad (2)$$

Empirically, positive and significant regression estimated values of $\beta 2$ and $\beta 3$ would imply sheepskin effects. Incidentally, we are assuming the error term ($\mu 2$) is identically, independently, distributed with a zero mean and a homoscedastic variance, and it is also independent of the included explanatory variables thus making the OLS an appropriate estimation technique.

Incidentally, if we exclude S in specification (2), we will refer to that specification as the Pure Credential (PC) model as it constrains continuous years of schooling to have zero impact on individual earnings.

Model II: Sheepskin Step-function Model or SM

If we take a non-parametric approach to exploring possible diploma effects, Ln Y to be a discrete step function of S with each year schooling is represented as a (0,1) variable.

For k years of completed schooling, we represent such a specification by equation (3) below.

$$\text{Ln } Y = \alpha + \sum \beta j\, Sj + \mu 3 \qquad (3)$$

Here each Sj is a (0, 1) dichotomous variables where $Sj = 1$ only if $S = j$ and $j = 1, 2 \ldots k$. Also note the assumption that the error terms $\mu 3$ is iid $\sim (0, \sigma^2)$ thus making the OLS a defensible estimation technique.

One can use the estimated values of βj to calculate the implied step size to represent the 'marginal' rate of return to the marginal year of schooling. Thus, we can evaluate the potential sheepskin effects by comparing the 'step size' for the year when a certain degree/diploma is conferred with the 'step sizes' that correspond to each of the years of schooling leading up to that degree or diploma.

4.3 Accounting for 'Ability' As a Possible Mediating Factor

We can introduce controls for measures of 'ability' in our sheepskin related specifications (2) or (3) by introducing an m-dimensional vector A and a vector of corresponding coefficient parameters, γ, to these specifications. For the sample used in this study, the measures of innate and cognitive ability of individuals are available.

Below we have we have extended the respective versions of (2) and (3) with controls for ability and written them as equations (4) and (5).

$$\text{Ln } Y = \alpha + \beta 1S + \beta 2D10 + \beta 3D12 + \gamma\ A + \mu 4 \qquad (4)$$

$$\text{Ln } Y = \alpha + \sum \beta j\ Sj + \gamma\ A + \mu 5 \qquad (5)$$

Further, for specifications (4) and (5), we assume that each error term is distributed identically and independently with a zero mean and a homoscedastic variance; also, it is independent of the respective included explanatory variables. This will ensure that the OLS will be an appropriate estimation technique for each specification.

Thus, analytically speaking, we can use the model specifications (2) through (5) to address two sets of empirically testable questions. Firstly, whether 'sheepskin' effects exist (specifications (2) and (3) above). If so, are they robust to inclusion of measures of 'ability', both cognitive and innate one? If the sheepskin estimates are not robust to such inclusions, these effects may be mediating such abilities. This will allow us to explore the nature of the observed sheepskin 'signal' in the sample. At present, we know rather little empirically about this important question particularly for developing countries and especially for Pakistan.

5. Data Description

The tenth round of the Pakistan Survey of Rural Education, Migration and Employment (PSREME) forms the basis of our empirical analysis. Conducted quarterly since 1986 by the International Food and Policy Research Institute (IFPRI) under the auspices of the Pakistan Ministry of Food and Agriculture, PSREME collects information about the individual as well as the household socio-economic characteristics for a sample of rural Pakistan. See Shabbir & Ashraf (2011) for additional details.

Essentially, in the tenth round of PSREME, the primary sample consisted of nearly 7000 individuals drawn in a stratified random manner from villages in two districts of Punjab (Attock and Faisalabad) and one of Sind (Badin). Pasha and Hasan (1982) rank Attock and Badin as the poorest districts in their respective provinces, while Faisalabad was a 'control', being a relatively affluent district. For further details on sample selection, see Sabot (1989).

PSREME contains valuable information about the individual's salary/wages, employment status, years of complete schooling, family background characteristics such as parental schooling as well as scores on measures of 'nature ability' and post-schooling 'cognitive skills'. See Khan (1993) and Malik & Farooqi (1993) for a more detailed discussion about the nature and suitability of these tests as measures of latent ability.

For the purposes of testing for sheepskin effects, PSREME is particularly valuable since schooling is measured as a 'continuous' variable i. e. the number of completed years.

This is in contrast to the typical Household Income and Expenditure Survey for many countries including Pakistan where schooling is categorized into discrete categories such as ‘Primary but less than Middle’ and ‘Middle but less than Matric’ and so forth. This precludes the use of HIES for testing sheepskin hypothesis since we are unable to distinguish those individuals who complete a course of study say, Middle or Matric and stop there vs those who begin the next level but dropout.

The other relative strength of this data set is the availability of scores on measures of ability, which is rather uncommon. This is very valuable as it allows us a test for a possible reason or explanation behind an observed sheepskin effect. Finally, the sample of 276 individuals used in the present study is obtained by selecting male or female wage earners or salaried employees for whom $\text{Ln } Y > 0$, and $S \geq 0$. Table 1 provides the definitions as well as the acronyms for the variables in this sample.

Table 1: Definitions and Statistical Description of Important Variables

Variable's Name	X	S.D.	Variable's Definition
Ln Y	6.89	0.74	Natural log of individual's monthly earnings that consist of wages or salary.
S	5.23	4.92	Years of schooling completed.
EXP	22.48	13.85	Individual's labor market experience; EXP = (Age-S-6); in years.
FEMALE	0.04	0.20	Dichotomous, equals 1 if respondent is a Female.
D5	0.54	0.50	Dichotomous; equals 1 if $S \geq 5$
D8	0.38	0.49	Dichotomous; equals 1 if $S \geq 8$
D10	0.31	0.46	Dichotomous; equals 1 if $S \geq 10$
D12	0.15	0.36	Dichotomous; equals 1 if $S \geq 12$
D14	0.07	0.25	Dichotomous; equals 1 if $S \geq 14$
Step Function Dummies			
Variable's Name	X	S.D.	Variables Definition
S1	0.01	0.08	Dichotomous; equal if S = 1
S2	0.01	0.10	Dichotomous; equal if S = 2
S3	0.04	0.19	Dichotomous; equal if S = 3
S4	0.02	0.15	Dichotomous; equal if S = 4
S5	0.11	0.31	Dichotomous; equal if S = 5
S6	0.03	0.16	Dichotomous; equal if S = 6
S7	0.03	0.17	Dichotomous; equal if S = 7
S8	0.07	0.26	Dichotomous; equal if S = 8
S10	0.16	0.37	Dichotomous; equal if S = 10
S12	0.08	0.27	Dichotomous; equal if S = 12
S14	0.07	0.25	Dichotomous; equal if S = 14
Test Scores			
COGNITIVE	27.78	13.00	A measure of 'output of schooling' obtained by averaging scores of specially designed tests of literacy and numeracy administered to individuals who were at least 10 years old and with 4 years of schooling.
RAVEN	24.99	6.56	Score on Raven's Progressive Matrices; it is 'a test of reasoning ability' that involves pattern matching and was administered to those who were at least ten years old.

* N = 116 when COGNITIVE is in the specification and N = 115 when both COGNITIVE and RAVEN are in any specification.

** For additional details on both the COGNITIVE and the RAVEN tests see Sabot (1989)

6. Empirical Regression Results and Discussion

Tables 2 through 6 present the empirical estimates for this study. Based on our sample of rural Pakistan, these regression results allow us to (a) test for discontinuous sheepskin effects of schooling against a Mincerian earnings function that postulates a log linear relationship between schooling and earnings and (b) explore the question whether the observed sheepskin affects stay robust when we include measures of innate as well as cognitive ability. The results related to (a) will allow us to empirically evaluate two contending paradigms i. e. productivity-enhancing human capital explanation versus the signaling or sheepskin interpretation of the typically observed schooling-earnings positive correlation. Since we do find significant evidence of sheepskin effects for important diploma levels, the empirical results related to (b) will allow us to investigate whether these observed sheepskin effects stay robust when we control for the available measures of 'ability'. This would allow us to shed light on the important yet not sufficiently explored question of what do such sheepskin effects represent and, in the case of the present sample, if they may represent innate or cognitive 'ability'.

The estimated 'baseline' Mincerian earnings function is presented in column 1 of Table 2 (column heading HC) while the remaining three columns of this table as well as

Table 2: Two Alternative Models: Human Capital (HC) vs. Pure Credential (PC)

	HC	Pure Credential (PC)		
	1	2	3	4
Constant	6.10* (34.29)	6.17* (35.19)	6.13* (34.06)	6.12* (34.07)
S	0.06* (5.80)			
EXP	0.04* (3.38)	0.04* (3.16)	0.04* (3.25)	0.04* (3.36)
$(EXP)^2$	-0.001* (-2.88)	-0.001* (-2.71)	-0.001* (-2.76)	-0.001* (-2.88)
FEMALE	-0.68* (-3.31)	-0.72* (-3.49)	-0.69* (-3.33)	-0.69* (-3.23)
D5		0.31* (2.66)	0.38* (2.92)	0.32* (2.77)
D8			-0.18 (-0.98)	
D10		0.35* (3.05)	0.34** (1.87)	0.22** (1.65)
D12			0.16 (0.84)	0.16 (0.86)
D14			0.24 (1.11)	0.24 (1.10)
Adjusted R^2	0.14	0.14	0.15	0.15
N	276	276	276	276

* Significant at 95 percent level; two-tailed t-test with t-statistics given in parentheses.
** Significant at 90 percent level for two-tailed t-test; yet significant at 95 percent level for one-tailed t-test.

Table 3: Mixed HC and PC Model: Both S and Diploma Dummies

	1	2	3
Constant	6.14* (33.46)	6.15* (32.96)	6.16* (33.22)
S	0.02 (0.69)	-0.02 (-0.37)	-0.04 (-0.87)
EXP	0.04* (3.23)	0.04* (3.22)	0.04* (3.25)
$(EXP)^2$	-0.001* (-2.77)	-0.001* (-2.76)	-0.001* (-2.83)
FEMALE	-0.71* (-3.42)	-0.69 (-3.34)	-0.70* (-3.36)
D5	0.19 (0.89)	0.47** (1.70)	0.52* (2.00)
D8		-0.13 (-0.59)	
D10	0.24 (1.23)	0.38** (1.82)	0.35** (1.73)
D14		0.28 (1.16)	0.31 (1.34)
Adjusted R^2	0.14	0.14	0.15
N	276	276	276

[*] Significant at 95 percent level; two-tailed t-test with t-statistics given in parentheses.
[**] Significant at 90 percent level for two-tailed t-test; yet significant at 95 percent level for one-tailed t-test.

Table 4: Step Function

	1	Implied Step Size
Constant	6.146* (30.29)	
EXP	-0.04* (-3.18)	
$(EXP)^2$	-0.001* (-2.73)	
FEMALE	-0.69* (-3.29)	
S = 1	0.17 (0.33)	0.17 (0.33)
S = 2	-0.31 (-0.75)	-0.48 (-0.76)
S = 3	-0.02 (-0.08)	0.29 (0.63)
S = 4	-0.10 (-0.20)	-0.08 (-0.22)
S = 5	0.34* (2.24)	0.44 (1.42)
S = 6	0.57* (2.05)	0.23 (0.78)
S = 7	0.27 (1.02)	-0.30 (-0.83)
S = 8	0.21 (1.15)	-0.06 (-0.21)
S = 10	0.53* (3.96)	0.32 (1.70)
S = 12	0.68* (3.68)	0.15 (0.80)
S = 14	0.93* (4.96)	0.25 (1.14)
Adjusted R^2	0.13	
No sample observations for S9, S11 & S13. * Significant at 95% level		

The estimates presented in Table 3 and Table 4 are somewhat differentiated attempts to test for sheepskin effects. However, the main premise of these specifications is that a positive and significant coefficient estimate for dummy variables representing those years of schooling that mark completion of a degree or diploma will essentially reflect sheepskin effects. In the backdrop of the Mincerian specification that represents the human capital view and implies a constant rate of return to any additional year of schooling, such a discontinuity will signify a 'bonus' rate of return for those years of schooling that mark completion of a degree/diploma. This would make degree completion years as 'special'; thus asserting that years of schooling are not all 'created equal' as implied in the human capital viewpoint. Of course, once we are able to identify all such sheepskin effects, we would still want to try to understand their nature by exploring the underlying mechanism. We try to accomplish this task through the empirical results noted in Table 5 as well as Table 6. More specifically, we explore empirically whether the observed sheepskin effects in this sample reflect innate and/or cognitive 'ability'.

Let me now make a few specific comments about the reported empirical results. First, I would discuss the results in Table 2-Table 4 which pertain to first of our stated objectives, namely, to check for the 'existence' of the relevant sheepskin or 'diploma' effects.

The estimated Mincerian earnings function reported in column 1, Table 2 signifies a 6% annual rate of return, a concave earnings-experience profile (with EXP coefficient estimate of 0.04 and $(EXP)^2$ estimate of -0.001 – both significant at the 95% confidence level with two-tailed t-test. Thus, these estimates seem well behaved as they conform to the usual characteristics of the human capital specification. Incidentally, a negative and significant coefficient estimate of -0.68 for the dummy variable implies labor market discrimination to the detriment of female wage earners – an important result even though this issue is not our primary focus here. However, a word of caution while interpreting this particular regression result since there are only 11 females in the sample of nearly 300 wage earners. In any event, we will treat this human capital specification as per estimates in column 1 as the 'baseline' against alternatives that we will consider.

Let me now review, in turn, the specifics of the empirical estimates for the different attempts to test sheepskin effects. Columns 2-4 of Table 2 present the estimates for different permutations of the so-called Pure Credentials (PC) model per equation (2) but without the continuous years of completed schooling variable, S. Consequently, this specification signifies that schooling matters only through completed degrees. Interestingly, in general, the regression results pertaining to the PC specification exhibit significant and sizable estimated coefficients for D5 (completed Primary) and D10 (completed Matric) which are two of the important diploma award years in the Pakistan educational system. In addition, coefficient estimates regarding two other tertiary diploma categories, D12 (Bachelor's) and D14 (Master's) are positive (but not significant). The relatively lower significance level for these latter coefficient estimates may be attributable to comparatively smaller cell size. The proportion of tertiary students is relatively low in Pakistan in general and this being a rural sample and thus even less affluent, this proportion is even lower (see Table 1, only 15% of the sample had completed Bachelor's degree and only 7% completed Master's level). It is noteworthy that in a relatively larger and nationally representative sample for Pakistan, Shabbir (2013) does report sizeable, and significant positive coefficient estimates for D12 and D14 diploma certification levels as well thus signifying a strong case for the presence of sheepskin effects at these diploma categories in general. For the particular specifications noted in columns 2-4 in Table 2, the one represented in column 2 is the most clear and strong evidence of the presence of sheepskin effects for D5 (0.31) and D10 levels (0.35) – both estimates are significant at the 95 % confidence level with relevant two-tailed t-test. It is also useful to check if these positive and statistically significantly coefficient estimates for the dummy variables representing the respective diploma effects are robust if we include the continuous variable for years of completed schooling (S) in the specification. Table 3 reports the results of such an exercise. Most interestingly, note that that the coefficient estimate of S is not significantly different from zero whereas the diploma dummies, especially for D5 and D10, continue to have a positive sign. They also, in general, continue to be statistical significance at the 90% or a higher level for a two-tailed t test except in the case of the results noted in column 1. Incidentally, the coefficient estimate for D10 is very nearly significant at the 90% mark albeit for a one sided test, which may be credible if one has strong a priori belief in the direction of the effect being positive. Such an a priori assertion should be quite defensible in this case. In any event, the empirical results from Table 3 are supportive of diploma or sheepskin effects in rates of returns at several important terminal or diploma granting threshold levels of schooling. Incidentally, Shabbir (1991), that employed a much larger and national sample for Pakistan, similarly reported that strong diploma effects persisted even with the inclusion of S variable.

In addition, the estimates of the non-parametric, step function in Table 4 further buttress the existence of the relevant sheepskin effects in the present sample. This specification treats the (log) earnings to be a 'step function' of the years of completed schooling, representing each year of schooling by a dichotomous dummy variable. Thus no prior linearity structure is imposed on the individual (log) earnings function.

It is noteworthy that the empirical results reported in Table 4 signify positive coefficient estimates for the 5th, 10th, 12th, and 14th schooling year. These estimated coefficients are significant at the 95% level of confidence. However, the implied step sizes though large are significant at somewhat lower levels. For example, in case of S=5, estimated coefficient of the corresponding step size is significant at the 90% level for the single sided t-test whereas in the case of S=10, it is significant at 95% level for the single sided t-test. What can we infer from these results about the existence of the sheepskin effects in the context of the step function non-parametric approach? Essentially, these results support the previously discussed evidence in favor of the sheepskin effects (Table 2 and Table 3). However, the thinning out of cell size i. e. number of data points for each level of schooling due to relatively smaller sample size may have made the estimates of the step sizes less precise. However Shabbir (1991) that uses a larger and national sample for Pakistan, reports positive, large and significant step sizes for the 8th, 10th, and 12th years of schooling. This provides strong evidence in support of the 'sheepskin' effects at these important schooling levels in the case of Pakistan.

In summary, the empirical results about the existence of sheepskin effects for our sample, there is strong evidence (presented in Tables 2-4) of substantial sheepskin effects for the completion of the 5th grade (Primary), 10th grade (Matric or high school diploma) and somewhat mixed evidence for similar effects for the 12th grade (Intermediate) and 14th grade (Bachelor's). Now we turn to the other important question in this debate – are these sheepskin effects robust in the face of two available measures of 'ability'?

6.1 Effects of Innate 'Ability' and Cognitive 'Ability'

The observed 'sheepskin effects' may be due to a myriad reasons including one's 'ability'. Such abilities may correspond to innate factors and/or cognitive factors. Thus, it will be informative to test empirically if observed sheepskin effects still maintain their significance once we control for such measures of ability in the relevant individual earnings specifications.

In our sample, we have two variables that measure 'ability' - RAVEN, a purported measure of 'innate' ability and COGNITIVE that supposedly measures 'cognitive' ability. More specifically, as defined in the data description table (Table 1), RAVEN is the score on the Raven's Progressive Matrices. As such, it is 'a test of reasoning ability' (and thus 'innate ability') that involves pattern matching and was administered to those who were at least ten years old. On the other hand, COGNITIVE is a measure of 'cognition' that is obtained by averaging scores of specially designed tests of literacy and numeracy administered to at least ten year olds with a minimum of four years of schooling. Thus, it may be partially an 'output of schooling'. See Sabot (1989) for additional information on the nature of these tests

In this paper, we employ RAVEN and COGNITIVE, separately and jointly as controls to test if the observed sheepskin effects stay robust. Table 5 and Table 6 provide the relevant empirical results. However, before I discuss these results, I would like to make an observation these measures of ability. Early on, empirical studies such as Boissiere et al. (1985) were amongst the few attempts to recast 'true' human capital as measured by such metrics along with those of literacy and numeracy rather than years of schooling. In a sense, the sheepskin specifications and studies of the Boissiere et al. (1985) ilk share a skepticism aimed at the observed years of schooling as the literally correct or 'true' measure of human capital.

Let us now turn to the specific empirical results contained in Table 5 and Table 6. Table 5 presents results for the case when COGNITIVE alone is the sole 'ability'-related control variable introduced to the specification whereas Table 6 presents results with both COGNITIVE and RAVEN added. The results are quite interesting for several reasons.

Firstly, it is noteworthy that across the various specifications given in Table 5, COGNITIVE is statistically not significantly different from zero. However, in the HC specification (Col. 1), the coefficient estimate of S is still significant. This would weaken the assertions about COGNITIVE being the 'true' measure of schooling's output. In general, this will be a very interesting result, however, since list wise deletion of missing variables significantly reduced the sample size as well as truncated observed schooling so that there are no observations with less than 6 years of schooling could also be a factor responsible for this empirical result. Thus, a grain of salt is in order on that count. Secondly, regarding the sheepskin effects, several of these sheepskin effects stay robust even when COGNITIVE is included as an additional independent variable. In particular, in Col. 2 (PC specification), the coefficient estimate of D10 (Matriculation) stays positive and significant at the 95% level whereas those for D12 (Intermediate) and D14 (Bachelor's) continue to be positive but are not statistically significant (though D14 may be considered significant at almost 90% level 1-tailed t-test). Incidentally, in Col. 3 S is not significant and R^2 is relatively lower, we consider PC as in Col. 2 to be a superior specification empirically.

In any event, the step function specification as per Col. 4 also lends support to the fact the sheepskin estimates are robust to the inclusion of COGNITIVE as a measure of ability. As can be observed in column 4, significant and positive coefficient estimates persist at the 10th (S10 or Matric), 12th, (S12 or Intermediate) and the 14th (S14 or Bachelor's) years of schooling that correspond to important diploma awarding thresholds.

Table 5: Controlling for Cognitive Ability

	1	2	3	4
Constant	5.97* (27.47)	6.42* (36.97)	6.25* (15.97)	6.30* (31.47)
S	0.07* (3.47)		0.02 (0.46)	
EXP	0.04* (2.96)	0.03* (2.68)	0.03* (2.70)	0.03* (2.79)
$(EXP)^2$	-0.001** (-1.98)	-0.001** (-1.69)	-0.001** (-1.74)	-0.001** (-1.80)
FEMALE	-0.32 (-1.56)	-0.33 (-1.58)	-0.32 (-1.53)	-0.31 (-1.46)
COGNITIVE	0.002 (0.46)	0.001 (0.34)	0.001 (0.31)	0.001 (0.31)
D10		0.27* (2.19)	0.18 (0.80)	
D12		0.08 (0.51)	0.03 (0.16)	
D14		0.24 (1.24)	0.19 (0.87)	
S6				0.31 (1.08)
S7				0.13 (0.55)
S8				0.15 (0.91)
S10				0.36* (2.42)
S12				0.45* (2.55)
S14				0.68* (3.34)
Adjusted R^2	0.18	0.17	0.16	0.16
N	116	116	116	116

* Significant at 95 percent level; two-tailed t-test with t-statistics given in parentheses.
** Significant at 90 percent level for two-tailed t-test; yet significant at 95 percent level for one-tailed t-test.

Table 6: Controlling for both Cognitive and Native Ability

	1	2	3	4
Constant	6.11* (22.76)	6.59* (25.92)	6.42* (15.01)	6.47* (23.19)
S	0.07* (3.57)		0.03 (0.51)	
EXP	0.03* (2.83)	0.03* (2.54)	0.03* (2.57)	0.03* (2.65)
$(EXP)^2$	-0.001** (-1.86)	-0.001** (-1.58)	-0.001** (-1.62)	-0.001** (-1.67)
FEMALE	-0.33 (-1.63)	-0.35 (-1.64)	-0.34 (-1.59)	-0.33 (-1.52)
COGNITIVE	0.002 (0.46)	0.001 (0.34)	0.001 (0.31)	0.001 (0.28)
RAVEN	-0.01 (-0.88)	-0.01 (-0.91)	-0.01 (-0.93)	-0.01 (-0.81)
D10		0.28* (2.20)	0.19 (0.80)	
D12		0.10 (0.57)	0.03 (0.18)	
D14		0.26 (1.33)	0.21 (0.94)	
S6				0.28 (0.97)
S7				0.15 (0.60)
S8				0.15 (0.89)
S10				0.37* (2.43)
S12				0.46* (2.60)
S14				0.72* (3.44)
Adjusted R^2	0.18	0.16	0.16	0.15
N	115	115	115	115

* Significant at 95 percent level; two-tailed t-test with t-statistics in parentheses.

** Significant at 90 percent level

Incidentally, we are unable to test the robustness of the coefficient estimate for D5 that was a significant sheepskin node in earlier estimates since it appears that D5 loses all observations once we insist on including COGNITIVE that by construction requires a minimum of 4 years of schooling. It appears that using this filter happens to remove all observations for individuals with very low levels of schooling.

Finally, Table 6 contains the empirical estimates when we include both RAVEN and COGNITIVE measures of 'ability' in our various specifications. First, note that neither of these variables have coefficient estimates that can be considered significantly different from zero. In any event, the coefficient estimates of D10 in Col. 2 (PC specification) as well as the coefficient estimates of S10, S12 and S14 as in the step function specification are very similar to those in the case of Table 5 – in fact, as a whole, qualitatively, the sheepskin robustness results are very similar to those in Table 5.

In conclusion, on the basis of the results in Table 5 and Table 6 (see 2nd columns of these tables), we observe that even after controlling for innate as well as cognitive ability, sheepskin effects for the PC version persist. In particular, note the relative robustness of the sheepskin dummy variables; D10 coefficient estimate – positive and significant at 95% significance level, 2-tailed t-test while D12 (positive thought not significant) and D14 (positive and significant at almost 90% 1-tailed t-test). Note that initially when introduced by itself, the coefficient estimate of the continuous years of schooling variable, S, stays positive and significant even when these ability measures are included (Col.1 in both Table 5 and Table 6). However, when both S and the dichotomous dummy variables to represent degrees or diplomas are included, the S coefficient does not stay statistically significant (as per results in Col 3 of both Table 5 and Table 6). While Col. 3 provides only minimal indication of sheepskin effects, the results in Col. 2 and Col. 4 provide relatively much clearer and stronger evidence that the sheepskin effects persist even when we control for the available ability measures, RAVEN and COGNITIVE. Note that besides the Pure Credentials (PC) specification, the step function estimates also still reaffirm positive and statistically significant coefficient estimates at the important diploma awarding years that correspond to the 10th (S10 or Matric), 12th, (S12 or Intermediate) and the 14th (S14 or Bachelor's) years of schooling even when ability is controlled for. Thus, in conclusion, the observed sheepskin effects have generally proven to be robust in the face of controlling for innate as well cognitive ability measures. This would imply the need for continuing the search for other measures of ability including the latent ones (Aslam et al. (2010, 2012) or other direct measures of plausible factors such as motivation, persistence and ability to persevere and complete tasks or goals.

7. Conclusion

There are two main conclusions of this paper based on this sample.

Firstly, significant sheepskin effects *exist* for the case of rural Pakistan. There are important nonlinear increases in the rates of returns to schooling for important diploma levels such as completed Primary, Matriculation, Intermediate and Bachelor's degree for wage earners. These empirical results align more with the signaling or the screening hypothesis vs. the human capital view about the effect of schooling on individual wages or earnings. These empirical findings about the existence of sheepskin effects are consistent with Shabbir (1991, 2013) for Pakistan and other developing country studies such as Olfindo (2018) for the Philippines and Hendajany & Widodo (2016) for Indonesia.

Secondly, these observed 'sheepskin' effects *persist* even when we include measures of 'ability – both innate ability and cognitive ability. This is a very important finding, as it constitute an attempt to try to understand the possible mechanisms underlying any observed sheepskin effects. There are relatively very few such studies for the developed as well the developing countries including Pakistan. A similar study in the same vein was Shabbir (2013) which checked and reported that the sheepskin effects found in a nationally representative sample for Pakistan were robust to inclusion of measured family background. We definitely need more such attempts to explore the nature of the underlying mechanisms that manifests themselves in the form of sheepskin signals.

8. Policy Recommendations

Firstly, given significant and persistent sheepskin effects imply that social rates of return may come in below the private rates of return for different levels of schooling. When we spend public or society's money for education, it should go to finance those levels of schooling where sheepskin effects are minimal and the dominant impact of schooling is to increase productivity-enhancing skills. Thus, the social rate of return alone should guide the allocation of public funds.

Secondly, 'dropping out' of school without completion should be minimized, this is true even when the payoffs to completion are mostly private.

Finally, more studies need to be done and appropriate data on completed years of schooling collected. This is necessary to add to the relatively meager empirical knowledge we have about the relative importance of sheepskin (or 'signaling', in general) vs. the productivity-enhancing human capital investments in Pakistan and developing countries generally. Since the developing countries have fewer public resources to invest in schooling, it is more important that social benefit is the primary driver of such allocations.

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